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Mathematics education for relevance, responsiveness, and viability in Africa within the Fourth Industrial Revolution era

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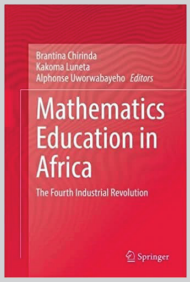

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Review title:
Mathematics education for relevance, responsiveness, and viability in Africa within the Fourth Industrial Revolution era

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Introduction

This outstanding book is fertile ground for seminal perusal by researchers and practitioners alike, across all educational levels, interested in offering a relevant and responsive mathematics curriculum that integrates resonances of ever-changing reform invariably evokes. The intriguing foreword accurately captures the core arguments and commendably offers an eagle's eye review. It sets the scene first by citing some reflections on encounters with teachers from three different countries in Africa (South Africa, Tanzania, and Uganda) on the use of remote communication. This is an apt caution that, although the author is from England her subject matter transcends site-bound limitations as an experienced, well-rounded scholar with vast working experience from Africa (Rwanda and Kenya included) gained through projects run by the African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC) (Golding, 2019). Coronavirus disease 2019 (COVID-19) pandemic forced all of us in Africa to embrace technology, particularly online and through the internet of things (IoT). Clearly the editors made a right choice to have such a distinct scholar in the person of Golding write the foreword, given her experience of working for AIMSSEC with the intent to promote active inquiry-based learning, mathematical thinking, communication, and problem-solving skills. These skills are required in the Fourth Industrial Revolution (4IR) era as reflected in the different chapters.

Thesis

The title *Mathematics Education in Africa – The Fourth Industrial Revolution* well captures the defining context within which the authors discuss the various tenets of the binding theme. The titles of the 19 chapters presented accurately display a constructive alignment of the authors' arguments to the *central issue as captured by the collection title*. Thirteen titles explicitly reflect the context of the 4IR giving readers surety that the authors would argue for a review of the teaching, learning and assessment of mathematics from basic to higher education to address the demands brought by 4IR.

The topography of the Table of Contents reveals *coverage* in terms of the country within Africa. Eight chapters indicate the country where the study was undertaken. Reading through the titles is also a beneficial index for spotting the targeted focus in terms of the educational levels comprising primary and/or secondary schools, tertiary education (pre-service or in-service) and general coverage. In cases where the title does not indicate the country and educational level, immediately after the table of contents provision is made of a brief profile about each of the editors and contributors.

There is a clear structural facility for the reader to select from the chapters the readings closest to one's teaching and learning environment. This should compensate for what could have been a challenge relating to *the ordering of the chapters*, given the complex coverage in terms of the educational level, country, line of argument and contributor. The ultimate sequence of the chapters appears to have been guided by the author's sequential positioning in the continuum of the entire collection's line of argument supported either theoretically or through practical classroom examples around issues on: (1) the readiness of mathematics education in Africa to educate for the 4IR and to evaluate its potential impact (*Chapters 1 to 5*); (2) constructive

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alignment of curriculum transformation with requisite 4IR skills (*Chapters 2, 3, 6, 10, 11, 12, 13, 16, 17, 18 and 19*), and (3) challenges and possible solutions of 4IR (*9, 14 and 15*). Noteworthy in the organisation of the chapters is that in almost all the chapters these three axes are addressed in an integrated fashion, and this could have been another challenge that influenced the decision for ordering the chapters as they appear.

The authors' arguments throughout the book have been captured such that they are relatively easy to follow. Although they are from different educational backgrounds, experiences, learning environments, and emanate from the facilitation of learning at different educational levels, the contributors did not deviate from the central theme. Albeit from the writers' differently contextualised discussions, the thread coalescing individual chapters around the central theme is maintained as the reader goes from one chapter to another. In cases where the author's argument(s) and/or suggested potential solutions require more mathematical clarity as in Chapters 2, 11, 12, 13, 14, 15 and 19, practical examples have been provided to allow the reader to make sense of the issues under discussion and to attain own interpretation.

Certainly, the authors' arguments with their cited examples provoke the reader's thoughts. For example, reflection on issues and examples cited in Chapter 2 that back up an argument for place-based mathematics could be whether it is not related to what Horsthemke and Schäfer (2007, p. 2) referred to as 'a call for the introduction and incorporation of so-called ethnomathematics, and more particularly 'African mathematics', into secondary and tertiary curricula'. The author in Chapter 2 describes place-based mathematics and its relevance to the curriculum as the mathematics that takes cognisance of the community and the relationship that the community has to the land and its people. He further argues for decolonising the mathematics curriculum through the place-based mathematics emphasising that learners should be able to see the relevance and usefulness of mathematics by relating it to their community, culture, and context. To this end, it would be necessary to revisit the argument by Horsthemke and Schäfer (2007) that:

> [*A*]s mathematical beliefs and ideas may differ … across cultures, the manifestation of mathematical practices and skills may so differ … Similarly, while they may differ in their manifestation, mathematical activities, and practices … are transcultural, in that they appear to be carried out by every cultural group ever studied. (p. 8)

There are instances where *authors use practical examples to demonstrate the kinds of tasks* they thought are linked to the skills and competencies required for the 4IR. For example, in Chapter 11, the author based his presentation from an autoethnography perspective and using storytelling, he shares how he has ultimately designed an exemplary activity that deals directly with mathematics content that is prescribed in the intended curriculum the practising mathematics teachers follow. He argues that 'a fully fletched mathematics curriculum aligned with the 4IR requires changes in de-emphasising (and some instances, shedding) current content and using digital technologies with which to do mathematics'. In Chapter 12, the authors have shown the relevance of instrumental orchestration to integrating GeoGebra as a tool for teaching specific mathematical content (Solving linear inequalities). They thereafter provided some guiding principles to teachers on making technology integration decisions. In Chapter 13, the author also demonstrated that mastering the features of GeoGebra in relation to the mathematics concepts can enhance the mathematical learning process through Information and Communication Technologies (ICT) and enable students to accommodate requirements for the 4IR. It is commendable that the authors' contributions encourage us to be innovative about our contemporary settings.

The famous John Lubbock quote 'What we see depends mainly on what we look for' (Hodgins, 2008) sums up the contributions. The critiques will all depend on where you are standing (Edgar & Pair, 2005). Evidence is there from the authors' contributions that different countries in Africa share similar challenges that impact negatively on the teaching of mathematics in the 4IR era. However, I find those challenges somewhat over-emphasised as in Chapters 1, 4, and 9. The expectation is that as we progress post the advent of the COVID-19 pandemic, there should be an incremental improvement in the different countries to mitigate most of the challenges. For example, in Chapter 3 the authors advocate for the introduction of competency-based curricula (CBC). They examined the non-cognitive aspects of mathematics in the CBC in six African countries and the results of their study revealed how to a large extent, the curricula have incorporated the skills needed for the 4IR.

Significance

I find the quote by Julie (2022) in Chapter 11 apt as a prelude to this section. He remarks that:

> Any story is interpreted by the reader of it. I thus do not offer any direct conclusions. Instead, I close with Denny's … advice to 'allow readers 'elbow room'… [*to enable*] the reader to draw reasoned conclusions. (p. 200)

For me, this book opens our eyes to continue raising difficult questions to inspire and sustain a critical discourse around *Mathematics Education in* Africa in the context of the 4IR. The authors from the various countries in Africa critically reflected on the past and present to create the future on mathematics education in their different contexts faced with the challenges of the 4IR. The book is thus a rich source of information on research in mathematics education and the 4IR for the international communities interested in education issues in Africa.

I commend the editors and the contributors for succeeding in providing a research-based resource for graduate students,

mathematics teachers, mathematics education curriculum developers and policymakers, research enthusiasts, and everyone interested in Mathematics Education and the 4IR at various levels of education in Africa.

References

Edgar, E., & Pair, A. (2005). Special education teacher attrition: It all depends on where you are standing. *Teacher Education and Special Education, 28*(3–4), 163–170. https://doi.org/10.1177/088840640502800403

Golding, J. (2019). *East African teacher educators learning at a distance*. Retrieved n.d. from https://www.london.ac.uk/sites/default/files/uploads/METEA-TRA-Jennie-Golding-Final-Report.pdf

Hodgins, D.C. (2008). What we see depends mainly on what we look for (John Lubbock, British Anthropologist, 1834–1913). *Addiction, 103*(7), 1118–1119. https://doi.org/10.1111/j.1360-0443.2008.02282.x

Horsthemke, K., & Schäfer, M. (2007). Does 'African mathematics' facilitate access to mathematics? Towards an ongoing critical analysis of ethnomathematics in a South African context. *Pythagoras, 65*, 2–9. https://doi.org/10.4102/pythagoras.v0i65.85

Julie, C. (2022). Fault lines in designing learning activities for practising mathematics teachers: An autoethnographic account. In B. Chirinda, K. Luneta, & A. Uworwabayeho (Eds.), *Mathematics Education in Africa*. Springer, Cham. https://doi.org/10.1007/978-3-031-13927-7-11.